

CLAIMS

What is claimed is:

- 1 1. A method of determining a Layer 2 path between a source device and a
2 destination device in a switched network, the method comprising the computer-
3 implemented steps of:
4 determining a Layer 3 path between the source device and the destination device,
5 wherein the Layer 3 path comprises information identifying two or more
6 Layer 3 devices;
7 determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3
8 path; and
9 concatenating the subpaths to result in creating and storing information
10 representing the Layer 2 path.
- 1 2. The method as recited in Claim 1, wherein determining a subpath for each
2 contiguous pair of Layer 3 devices comprises the steps of:
3 determining a first interface on a first node of the contiguous pair that is connected
4 to a second interface on a second node of the contiguous pair for a given
5 subnet; and
6 selecting a relevant VLAN between the first and second nodes of the contiguous
7 pair based on the first and second interfaces; and
8 gathering current spanning tree information for the relevant VLAN.

1 3. The method as recited in Claim 2, wherein selecting a relevant VLAN between the
2 first and second nodes of the contiguous pair comprises the steps of:
3 selecting a matching native VLAN of the first and second node of the contiguous
4 pair as the relevant VLAN when the first interface and the second interface
5 of the first and second nodes respectively of the contiguous pair are non-
6 VLAN trunking interfaces;
7 selecting a matching active VLAN that is designated to carry traffic to a next hop
8 as the relevant VLAN when the first interface and the second interface of
9 the first and second nodes respectively of the contiguous pair are VLAN
10 trunking interfaces; and
11 selecting a native VLAN that is on a non-VLAN trunking interface as the relevant
12 VLAN when one of the nodes of the contiguous pair has the non-VLAN
13 trunking interface.

1 4. The method as recited in Claim 1, wherein determining a subpath for each
2 contiguous pair of Layer 3 devices further comprises the steps of:
3 tracing a first path segment from a first node of the contiguous pair by following a
4 spanning tree associated with a relevant VLAN for the contiguous pair to a
5 root of the spanning tree;
6 tracing a second path segment from a second node of the contiguous pair by
7 following the spanning tree associated with the relevant VLAN for the
8 contiguous pair to the root of the spanning tree; and

001250-60/58560

9 concatenating the first second path segments to result in creating and storing the
10 subpath for the contiguous pair.

1 5. The method as recited in Claim 4, wherein concatenating the first path segment
2 and the second path segment to result in creating and storing the subpath for the
3 contiguous pair includes the step of eliminating extraneous devices from the first
4 and second path segments.

1 6. The method as recited in Claim 1, wherein concatenating the subpaths to result in
2 creating and storing information representing the Layer 2 path includes the step of
3 eliminating extraneous devices from the subpaths.

1 7. A method of determining a Layer 2 path between a source device and a
2 destination device in a switched network, the method comprising the computer-
3 implemented steps of:
4 determining a Layer 3 path between the source device and the destination device,
5 wherein the Layer 3 path comprises information identifying two or more
6 Layer 3 devices;
7 identifying contiguous pairs of Layer 3 devices in the Layer 3 path;
8 determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3
9 path;
10 determining whether any contiguous pair of Layer 3 devices has no subpath;

11 concluding that there is no Layer 2 path when any contiguous pair of Layer 3
12 devices has no subpath;
13 eliminating extraneous devices in the subpaths; and
14 concatenating the subpaths to result in creating and storing information
15 representing the Layer 2 path when each of the contiguous pairs of Layer 3
16 devices has a subpath.

1 8. The method as recited in Claim 7, wherein determining a subpath for each
2 contiguous pair of Layer 3 devices comprises the steps of:
3 determining a first interface on a first node of the contiguous pair that is connected
4 to a second interface on a second node of the contiguous pair for a given
5 subnet when both the first node of the contiguous pair and the second node
6 of the contiguous pair have non-trunking interfaces;
7 determining a first native VLAN of the first interface and a second native VLAN
8 the second interface;
9 determining whether the first native VLAN matches the second native VLAN;
10 selecting the matching VLAN as a relevant VLAN between the first and second
11 nodes of the contiguous pair when the first native VLAN matches the
12 second native VLAN;
13 gathering a current spanning tree information for the relevant VLAN;
14 tracing a first path segment from the first node of the contiguous pair to a root of
15 the spanning tree by following the current spanning tree information
16 associated with the relevant VLAN to a root of the spanning tree;

tracing a second path segment from the second node of the contiguous pair to the root of the spanning tree by following the current spanning tree information associated with the relevant VLAN;

eliminating extraneous devices in the first and second path segments; and

concatenating the first path segment and the second path segment to result in creating and storing the subpath for the contiguous pair.

9. The method as recited in Claim 7, wherein determining a subpath for each contiguous pair of Layer 3 devices comprises the steps of:

- determining a non-trunking node of the contiguous pair when one of the nodes of the contiguous pair for a given subnet has a non-trunking interface and the other node of the contiguous pair has a trunking interface;
- determining the non-trunking interface on the non-trunking node of the contiguous pair as a first interface that is connected to a second interface on the other node of the contiguous pair;
- determining a native VLAN on the first interface;
- determining whether there is an active VLAN on the second interface that matches the native VLAN on the first interface;
- selecting the matching VLAN as a relevant VLAN between the non-trunking node and the other node of the contiguous pair when there is an active VLAN on the second interface that matches the native VLAN on the first interface;
- gathering a current spanning tree information for the relevant VLAN;

16 tracing a first path segment from the non-trunking node of the contiguous pair to a
17 root of the spanning tree by following the current spanning tree
18 information associated with the relevant VLAN to a root of the spanning
19 tree;
20 tracing a second path segment from the other node of the contiguous pair to the
21 root of the spanning tree by following the current spanning tree
22 information associated with the relevant VLAN;
23 eliminating extraneous devices in the first and second path segments; and
24 concatenating the first path segment and the second path segment to result in
25 creating and storing the subpath for the contiguous pair.

1 10. The method as recited in Claim 7, wherein determining a subpath for each
2 contiguous pair of Layer 3 devices comprises the steps of:
3 determining a first interface on a first node of the contiguous pair that is connected
4 to a second interface on a second node of the contiguous pair for a given
5 subnet when both the first node of the contiguous pair and the second node
6 of the contiguous pair have non-trunking interfaces; and
7 determining a first active VLAN of the first interface associated with the given
8 subnet and a second active VLAN the second interface associated with the
9 given subnet;
10 determining whether the first active VLAN matches the second active VLAN;

11 selecting the matching VLAN as a relevant VLAN between the first and second
12 nodes of the contiguous pair when the first active VLAN matches the
13 second active VLAN;
14 gathering a current spanning tree information for the relevant VLAN;
15 tracing a first path segment from the first node of the contiguous pair to a root of
16 the spanning tree by following the current spanning tree information
17 associated with the relevant VLAN to a root of the spanning tree;
18 tracing a second path segment from the second node of the contiguous pair to the
19 root of the spanning tree by following the current spanning tree
20 information associated with the relevant VLAN;
21 eliminating extraneous devices in the first and second path segments; and
22 concatenating the first path segment and the second path segment to result in
23 creating and storing the subpath for the contiguous pair.

- 1 11. A computer-readable medium carrying one or more sequences of one or more
2 instructions for determining a Layer 2 path between a source node and a
3 destination node in a switched network, the one or more sequences of one or more
4 instructions including instructions which, when executed by one or more
5 processors, cause the one or more processors to perform the steps of:
6 determining a Layer 3 path between the source device and the destination device,
7 wherein the Layer 3 path comprises information identifying two or more
8 Layer 3 devices;

9 determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3
 10 path; and
 11 concatenating the subpaths to result in creating and storing information
 12 representing the Layer 2 path.

1 12. The computer-readable medium as recited in Claim 11, wherein determining a
 2 subpath for each contiguous pair of Layer 3 devices comprises the steps of:
 3 determining a first interface on a first node of the contiguous pair that is connected
 4 to a second interface on a second node of the contiguous pair for a given
 5 subnet; and
 6 selecting a relevant VLAN between the first and second nodes of the contiguous
 7 pair based on the first and second interfaces; and
 8 gathering current spanning tree information for the relevant VLAN.

1 13. The computer-readable medium as recited in Claim 12, wherein selecting a
 2 relevant VLAN between the first and second nodes of the contiguous pair
 3 comprises the steps of:
 4 selecting a matching native VLAN of the first and second node of the contiguous
 5 pair as the relevant VLAN when the first interface and the second interface
 6 of the first and second nodes respectively of the contiguous pair are non-
 7 VLAN trunking interfaces;
 8 selecting a matching active VLAN that is designated to carry traffic to a next hop
 9 as the relevant VLAN when the first interface and the second interface of

007E50" 50258560

10 the first and second nodes respectively of the contiguous pair are VLAN
11 trunking interfaces; and
12 selecting a native VLAN that is on a non-VLAN trunking interface as the relevant
13 VLAN when one of the nodes of the contiguous pair has the non-VLAN
14 trunking interface.

1 14. The computer-readable medium as recited in Claim 11, wherein determining a
2 subpath for each contiguous pair of Layer 3 devices further comprises the steps of:
3 tracing a first path segment from a first node of the contiguous pair by following a
4 spanning tree associated with a relevant VLAN for the contiguous pair to a
5 root of the spanning tree;
6 tracing a second path segment from a second node of the contiguous pair by
7 following the spanning tree associated with the relevant VLAN for the
8 contiguous pair to the root of the spanning tree; and
9 concatenating the first second path segments to result in creating and storing the
10 subpath for the contiguous pair.

1 15. The computer-readable medium as recited in Claim 14, wherein concatenating the
2 first path segment and the second path segment to result in creating and storing the
3 subpath for the contiguous pair includes the step of eliminating extraneous devices
4 from the first and second path segments.

1 16. The computer-readable medium as recited in Claim 11, wherein concatenating the
2 subpaths to result in creating and storing information representing the Layer 2 path
3 includes the step of eliminating extraneous devices from the subpaths.

1 17. A computer-readable medium carrying one or more sequences of one or more
2 instructions for determining a Layer 2 path between a source node and a
3 destination node in a switched network, the one or more sequences of one or more
4 instructions including instructions which, when executed by one or more
5 processors, cause the one or more processors to perform the steps of:
6 determining a Layer 3 path between the source device and the destination device,
7 wherein the Layer 3 path comprises information identifying two or more
8 Layer 3 devices;
9 identifying contiguous pairs of Layer 3 devices in the Layer 3 path;
10 determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3
11 path;
12 determining whether any contiguous pair of Layer 3 devices has no subpath;
13 concluding that there is no Layer 2 path when any contiguous pair of Layer 3
14 devices has no subpath;
15 eliminating extraneous devices in the subpaths; and
16 concatenating the subpaths to result in creating and storing information
17 representing the Layer 2 path when each of the contiguous pairs of Layer 3
18 devices has a subpath.

- 1 18. The computer-readable medium as recited in Claim 17, wherein determining a
2 subpath for each contiguous pair of Layer 3 devices comprises the steps of:
3 determining a first interface on a first node of the contiguous pair that is connected
4 to a second interface on a second node of the contiguous pair for a given
5 subnet when both the first node of the contiguous pair and the second node
6 of the contiguous pair have non-trunking interfaces;
7 determining a first native VLAN of the first interface and a second native VLAN
8 the second interface;
9 determining whether the first native VLAN matches the second native VLAN;
10 selecting the matching VLAN as a relevant VLAN between the first and second
11 nodes of the contiguous pair when the first native VLAN matches the
12 second native VLAN;
13 gathering a current spanning tree information for the relevant VLAN;
14 tracing a first path segment from the first node of the contiguous pair to a root of
15 the spanning tree by following the current spanning tree information
16 associated with the relevant VLAN to a root of the spanning tree;
17 tracing a second path segment from the second node of the contiguous pair to the
18 root of the spanning tree by following the current spanning tree
19 information associated with the relevant VLAN;
20 eliminating extraneous devices in the first and second path segments; and
21 concatenating the first path segment and the second path segment to result in
22 creating and storing the subpath for the contiguous pair.

- 1 19. The computer-readable medium as recited in Claim 17, wherein determining a
2 subpath for each contiguous pair of Layer 3 devices comprises the steps of:
3 determining a non-trunking node of the contiguous pair when one of the nodes of
4 the contiguous pair for a given subnet has a non-trunking interface and the
5 other node of the contiguous pair has a trunking interface;
6 determining the non-trunking interface on the non-trunking node of the contiguous
7 pair as a first interface that is connected to a second interface on the other
8 node of the contiguous pair;
9 determining a native VLAN on the first interface;
10 determining whether there is an active VLAN on the second interface that matches
11 the native VLAN on the first interface;
12 selecting the matching VLAN as a relevant VLAN between the non-trunking node
13 and the other node of the contiguous pair when there is an active VLAN on
14 the second interface that matches the native VLAN on the first interface;
15 gathering a current spanning tree information for the relevant VLAN;
16 tracing a first path segment from the non-trunking node of the contiguous pair to a
17 root of the spanning tree by following the current spanning tree
18 information associated with the relevant VLAN to a root of the spanning
19 tree;
20 tracing a second path segment from the other node of the contiguous pair to the
21 root of the spanning tree by following the current spanning tree
22 information associated with the relevant VLAN;

23 eliminating extraneous devices in the first and second path segments; and
24 concatenating the first path segment and the second path segment to result in
25 creating and storing the subpath for the contiguous pair.

1 20. The computer-readable medium as recited in Claim 17, wherein determining a
2 subpath for each contiguous pair of Layer 3 devices comprises the steps of:
3 determining a first interface on a first node of the contiguous pair that is connected
4 to a second interface on a second node of the contiguous pair for a given
5 subnet when both the first node of the contiguous pair and the second node
6 of the contiguous pair have non-trunking interfaces; and
7 determining a first active VLAN of the first interface associated with the given
8 subnet and a second active VLAN the second interface associated with the
9 given subnet;
10 determining whether the first active VLAN matches the second active VLAN;
11 selecting the matching VLAN as a relevant VLAN between the first and second
12 nodes of the contiguous pair when the first active VLAN matches the
13 second active VLAN;
14 gathering a current spanning tree information for the relevant VLAN;
15 tracing a first path segment from the first node of the contiguous pair to a root of
16 the spanning tree by following the current spanning tree information
17 associated with the relevant VLAN to a root of the spanning tree;

18 tracing a second path segment from the second node of the contiguous pair to the
19 root of the spanning tree by following the current spanning tree
20 information associated with the relevant VLAN;
21 eliminating extraneous devices in the first and second path segments; and
22 concatenating the first path segment and the second path segment to result in
23 creating and storing the subpath for the contiguous pair.

21. A computer data signal embodied in a carrier wave, the computer data signal carrying one or more sequences of instructions for determining a Layer 2 path between a source node and a destination node in a switched network, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

- determining a Layer 3 path between the source device and the destination device, wherein the Layer 3 path comprises information identifying two or more Layer 3 devices;
- determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3 path; and
- concatenating the subpaths to result in creating and storing information representing the Layer 2 path.

1 ~~22.~~ A computer apparatus comprising:
2 a processor; and
3 a memory coupled to the processor, the memory containing one or more sequences
4 of instructions for determining a Layer 2 path between a source node and a
5 destination node in a switched network, wherein execution of the one or

more sequences of instructions by the processor causes the processor to perform the steps of:

- determining a Layer 3 path between the source device and the destination device, wherein the Layer 3 path comprises information identifying two or more Layer 3 devices;
- determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3 path; and
- concatenating the subpaths to result in creating and storing information representing the Layer 2 path.

23. A computer data signal embodied in a carrier wave, the computer data signal carrying one or more sequences of instructions for determining a Layer 2 path between a source node and a destination node in a switched network, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

- determining a Layer 3 path between the source device and the destination device, wherein the Layer 3 path comprises information identifying two or more Layer 3 devices;
- identifying contiguous pairs of Layer 3 devices in the Layer 3 path;
- determining a subpath for each contiguous pair of Layer 3 devices in the Layer 3 path;
- determining whether any contiguous pair of Layer 3 devices has no subpath;
- concluding that there is no Layer 2 path when any contiguous pair of Layer 3 devices has no subpath;

001E50-60458560

15 eliminating extraneous devices in the subpaths; and
16 concatenating the subpaths to result in creating and storing information
17 representing the Layer 2 path when each of the contiguous pairs of Layer 3
18 devices has a subpath.

1 24. A network device that can determine a Layer 2 path between a source node and a
2 destination node in a switched network comprising:
3 a network interface;
4 a processor coupled to the network interface and receiving information from the
5 network interface; and
6 a computer-readable medium accessible by the processor and comprising one or
7 more sequences of instructions which, when executed by the processor,
8 cause the processor to carry out the steps of:
9 determining a Layer 3 path between the source device and the destination
10 device, wherein the Layer 3 path comprises information identifying
11 two or more Layer 3 devices;
12 identifying contiguous pairs of Layer 3 devices in the Layer 3 path;
13 determining a subpath for each contiguous pair of Layer 3 devices in the
14 Layer 3 path;
15 determining whether any contiguous pair of Layer 3 devices has no
16 subpath;
17 concluding that there is no Layer 2 path when any contiguous pair of Layer
18 3 devices has no subpath;
19 eliminating extraneous devices in the subpaths; and

20 concatenating the subpaths to result in creating and storing information
21 representing the Layer 2 path when each of the contiguous pairs of
22 Layer 3 devices has a subpath.

1 25. A system for determining a Layer 2 path between a source node and a destination
2 node in a switched network, the system comprising:
3 means for determining a Layer 3 path between the source device and the
4 destination device, wherein the Layer 3 path comprises information
5 identifying two or more Layer 3 devices;
6 means for identifying contiguous pairs of Layer 3 devices in the Layer 3 path;
7 means for determining a subpath for each contiguous pair of Layer 3 devices in the
8 Layer 3 path;
9 means for determining whether any contiguous pair of Layer 3 devices has no
10 subpath;
11 means for concluding that there is no Layer 2 path when any contiguous pair of
12 Layer 3 devices has no subpath;
13 means for eliminating extraneous devices in the subpaths; and
14 means for concatenating the subpaths to result in creating and storing information
15 representing the Layer 2 path when each of the contiguous pairs of Layer 3
16 devices has a subpath.

add
#6